Beam Optics & Beam Size on Target

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Modular LBNE Lattice Design

$\beta^* = 64.8$ m : $\beta_{\max} = 103$ m

- The line is comprised of 4 distinct functional modules (excluding the FODO cells):
  - S1 : matching from MI→ NuMI→LBNE FODO cells including η_y killing;
  - S2 : horizontal dispersion suppression plus a 150 mr achromatic down-bend;
  - S3 : an achromatic 50 mr up-bend;
  - S4 : the FF to the target.
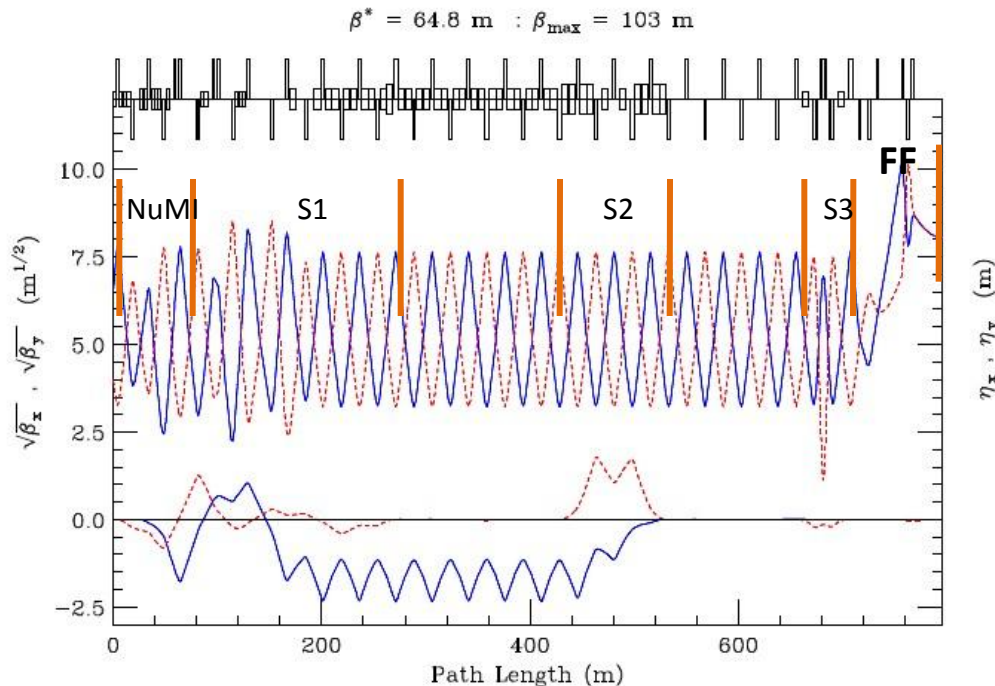
Beam size on the target is accomplished solely by tuning the Final Focus section matching quads.
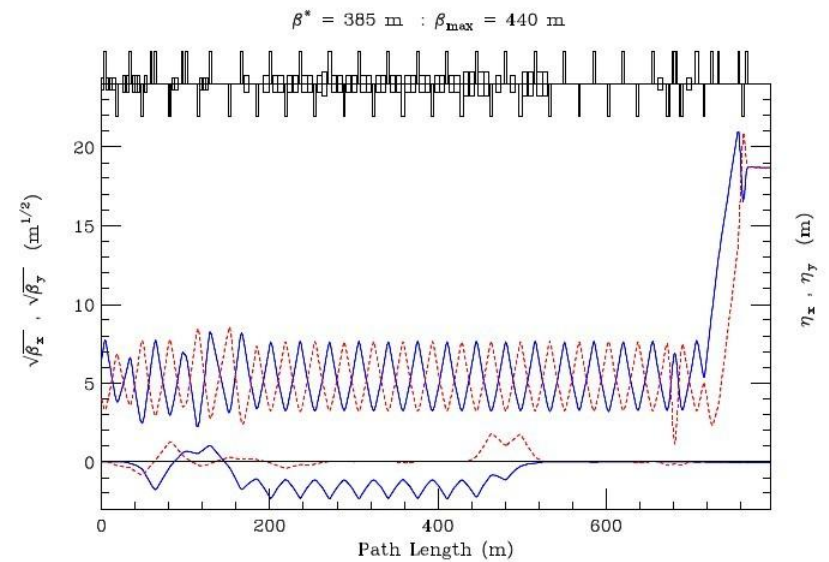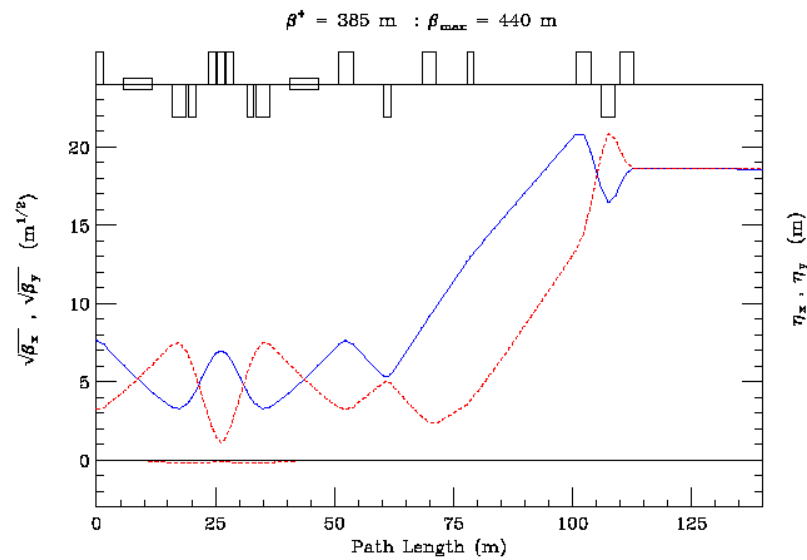
Final Focus Matching Quads

- Beam size is adjusted almost exclusively by tuning QF1, QD1, & QD2 — the triplet gradients change very little.
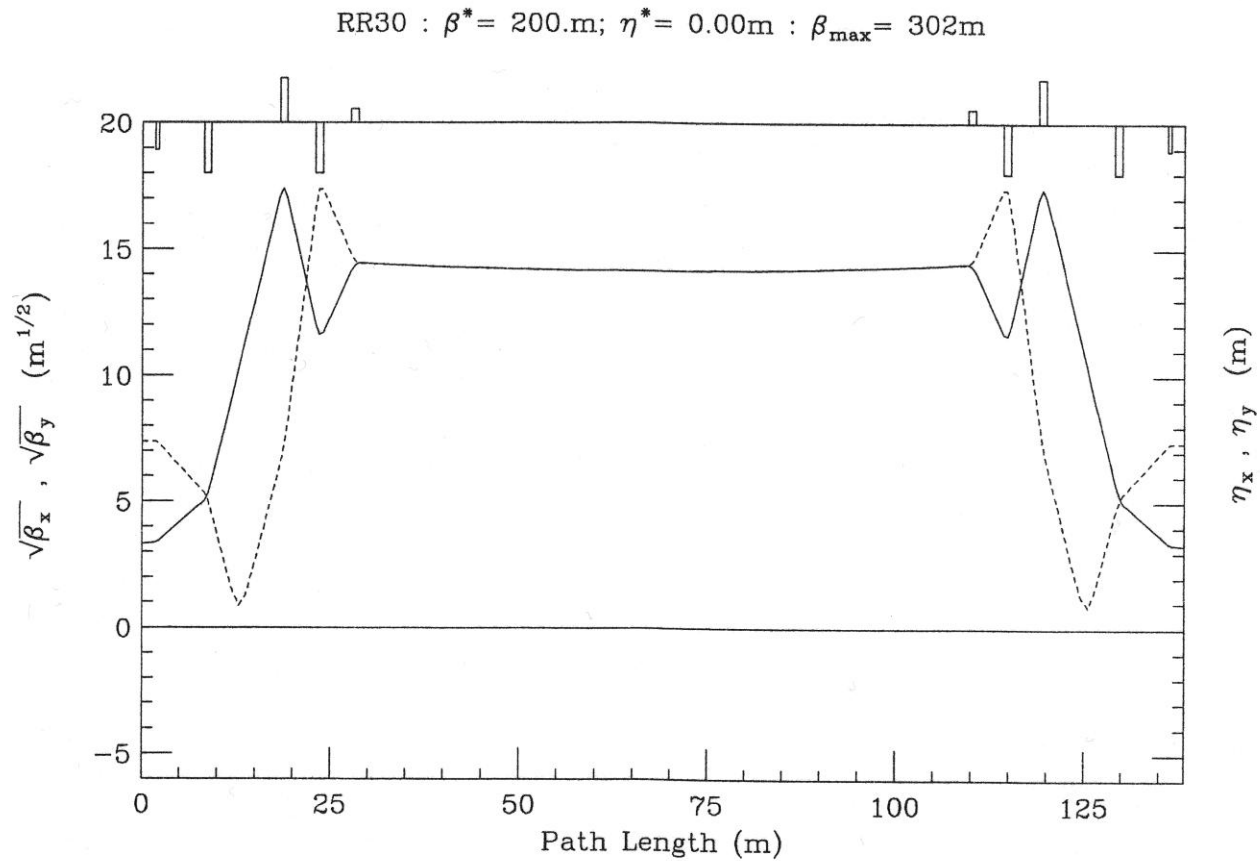

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QF1
QD2
QD1
FF TRIPLET
FINAL FOCUSING
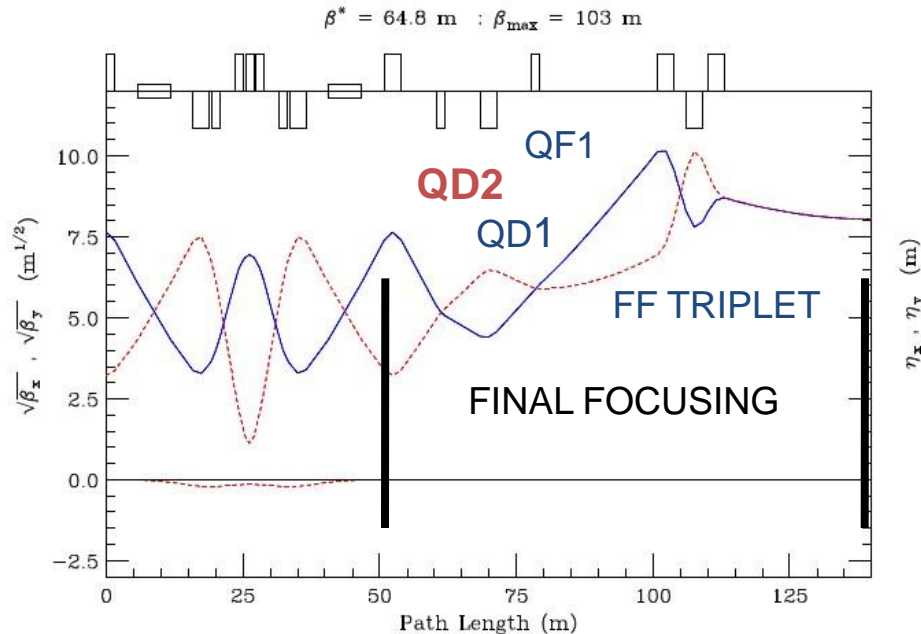
In the configuration shown the beam size can be adjusted from $\sigma < 1.0$ mm $\rightarrow$ 1.6 mm over the entire range 60 $\rightarrow$ 120 GeV/c before the QD2 gradient becomes excessive (~20 T/m).

Replacing the 5' QD2 with a 10' magnet removes the bottleneck & $\sigma = 3.0$ mm is achievable (possibly larger).

120 GeV/c & σ = 3.0 mm

Recycler High-β Insertion

RR30 : $\beta^* = 200.\text{m}$; $\eta^* = 0.00\text{m}$: $\beta_{\text{max}} = 302\text{m}$

Ω

over to Dave …